

Incomplete Neutralization of Sandhi Tones in Xiamen Southern Min

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Incomplete phonological neutralization has been widely reported, such as the neutralization of voiced versus voiceless codas in various languages [1, 2, 3]. A similar phenomenon has been observed in Mandarin tonal allophony. Acoustic analysis revealed very subtle differences between T2 and the rising sandhi tone derived from the T3 sandhi rule. The pitch height of the sandhied T3 is lower than that of T2 with the same tonal environment [4]. It was speculated that the low onset of the underlying T3 was maintained in the surface sandhi tone [5]. Xiamen Southern Min has a more complex tone sandhi pattern, in which one tone is substituted by another as a circular chain shift, as shown in Fig. 1 [6, 7]. Earlier studies have noted that the phonological description of the “tone circle” may oversimplify fine phonetic details, as none of the sandhi tones has exactly the same pitch patterns as the corresponding citation tone with the same transcription [8]. Given that both tones /44/ and /24/ are realized as [22] in tone sandhi, this study aims to examine whether the neutralization between the two sandhi tones is complete.

A picture-naming task was completed by participants of different generations, including 12 senior speakers (aged 61-87), 21 middle-aged speakers (aged 35-59) and 66 non-adult speakers (aged 4-19). Since the non-adult speakers were all bilingual in Southern Min and Mandarin, they were further divided into four groups based on their Southern Min proficiency, indicated by their scores in a vocabulary test. All five sandhi rules shown in Fig. 1 were included in the stimuli, with 11 disyllabic tokens for each sandhi rule. *F*₀ data were extracted on a time-normalized basis and z-score transformed. Generalized additive mixed models (GAMM) were fitted to the normalized *F*₀ data to test the statistical differences between the *F*₀ contours [9].

The results illustrated in Fig. 2 indicate that the neutralization between the sandhi tones of /44/ and /22/ is incomplete for most groups of speakers, revealed by the non-overlapping contours between /44/ > [22a] and /24/ > [22b] (the two red lines). The senior speakers neutralized the two sandhi tones completely, while the middle-aged and non-adult speakers of levels 1, 2 and 3 (Lv1 being the most proficient) produced the two sandhi tones with significant pitch differences. The non-distinct pattern of [22a] and [22b] by the least proficient group (Lv4) could be attributed to the wider confidence intervals shown in the model, resulting from large individual differences with a small group size (*N* = 6) and their overall less distinct tone realizations. For the groups with incomplete neutralization, the pitch height of the [22] derived from /44/ is consistently higher than that derived from /24/, which indicates that the lower onset of the citation tone may be maintained in the sandhi form. The increasing distance between [22a] and [22b] from senior, to middle-aged, to non-adult speakers indicates that the split of the neutralized [22] derived from two different underlying tones is a generational sound change.

Within-group individual variations were also examined with an additional GAMM model. The overlapping confidence intervals (indicating complete neutralization) based on the participant-level smooths presented in Fig. 3 confirm that individual patterns within each group were highly consistent. The two sandhi tones produced by senior speakers overlap across the whole contour, while a difference in pitch can be found at the contour onset produced by middle-aged speakers. As for non-adult speakers, except for those of the Lv4 group, no overlapping contour could be found across speakers. Therefore, it seems that there is an ongoing sound change towards a split between the neutralized [22] derived from different citation tones, given the pattern of complete neutralization in senior speakers, consistent pitch differences in non-adults' speech, and an intermediate pattern shown by middle-aged speakers' data. Such a trend contradicts the findings in Taiwan Southern Min, in which a merging trend towards complete neutralization was reported [10]. Whether the discrepancy between Xiamen and Taiwan Southern Min reflects dialectal difference or a state of flux in the sound change of neutralization requires further investigation.

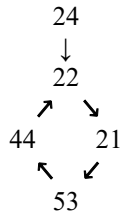


Fig. 1. Xiamen Southern Min tone circle for unchecked syllables

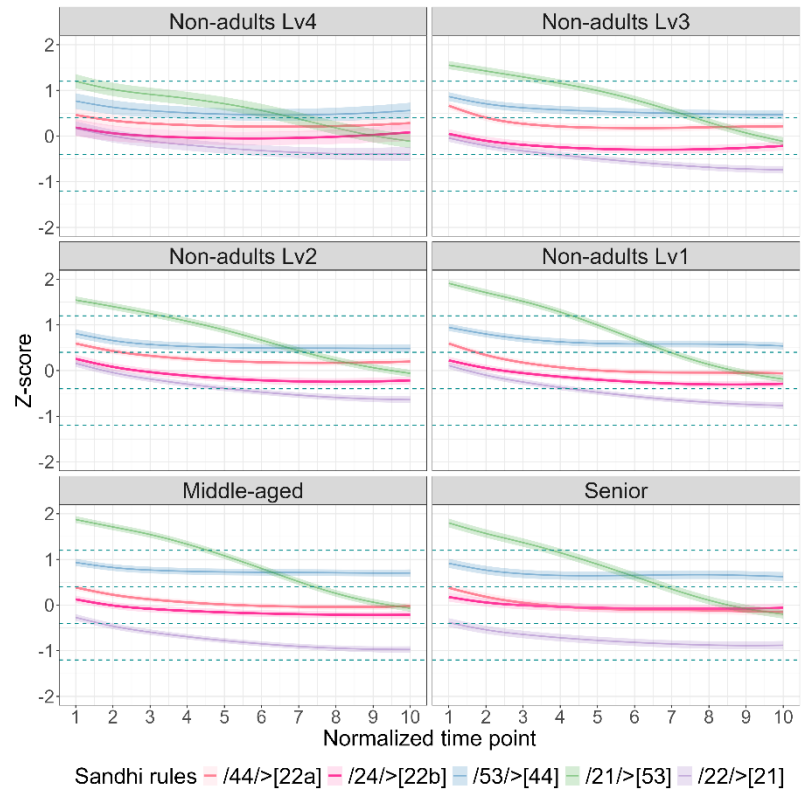


Fig. 2. GAMM-fitted F_0 contours of the sandhi tones by different groups

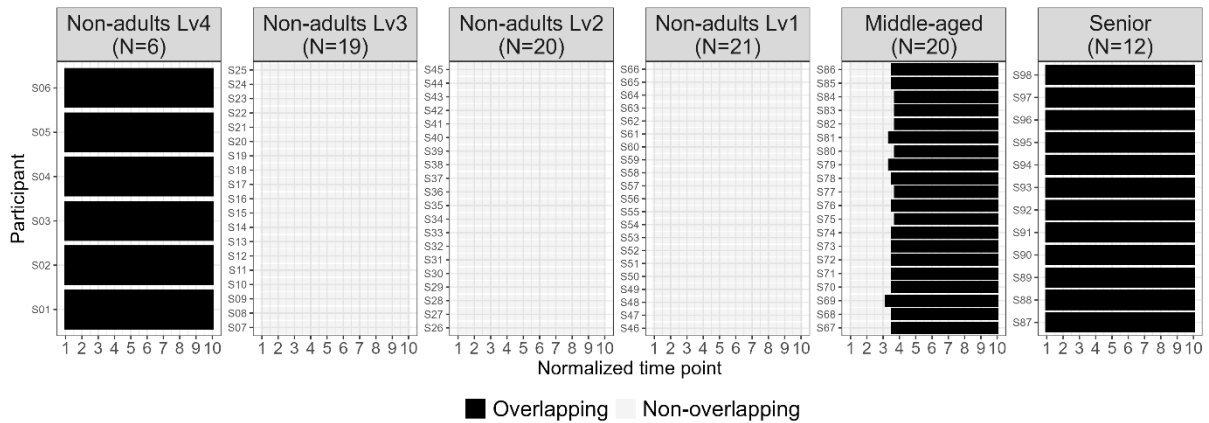


Fig. 3. Overlapping confidence intervals of the two sandhi tones [22] by individual speakers

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